FIG. 1

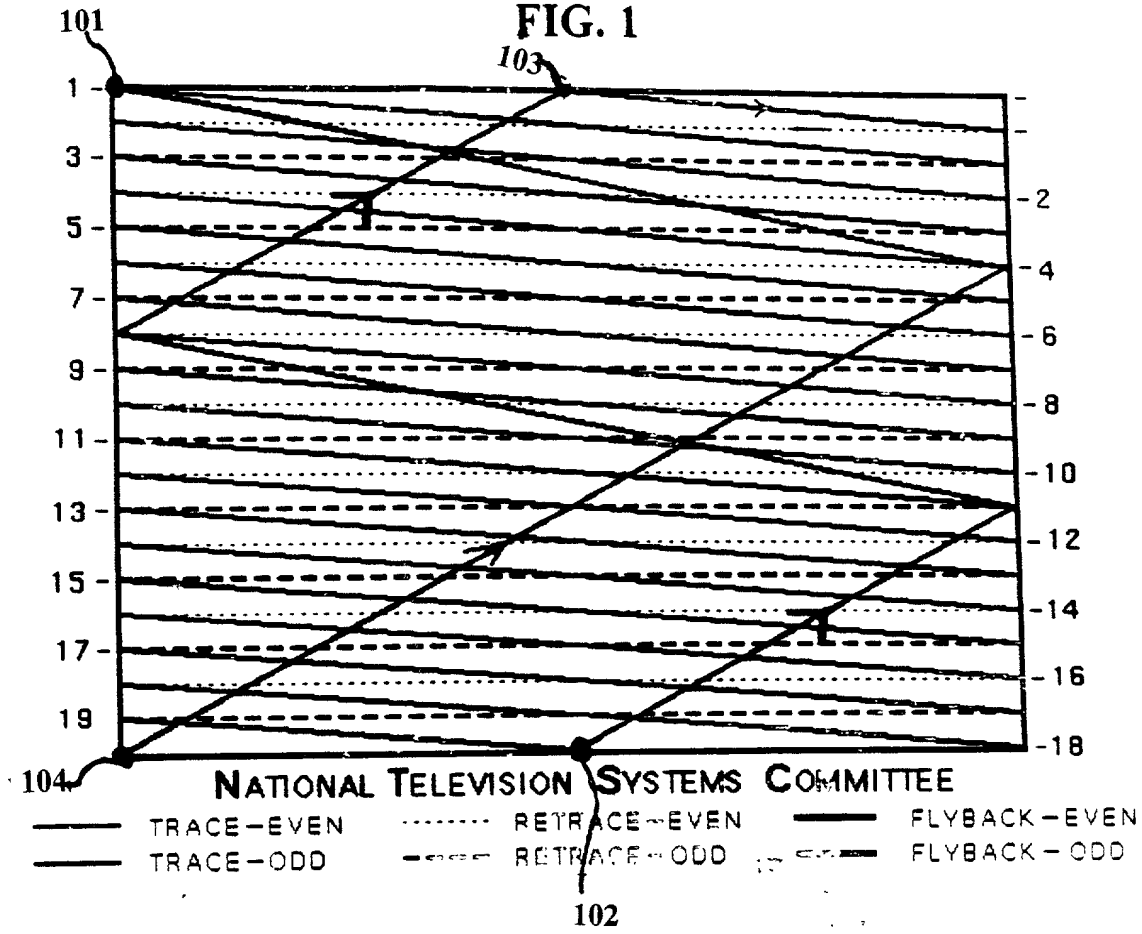

101
103
1
3
5
7
9
11
13
15
17
19
2
4
6
8
10
12
14
16
18
104
NATIONAL TELEVISION SYSTEMS COMMITTEE
TRACE—EVEN
TRACE—ODD
RETRACE—EVEN
RETRACE—ODD
FLYBACK—EVEN
FLYBACK—ODD
102

FIG. 2

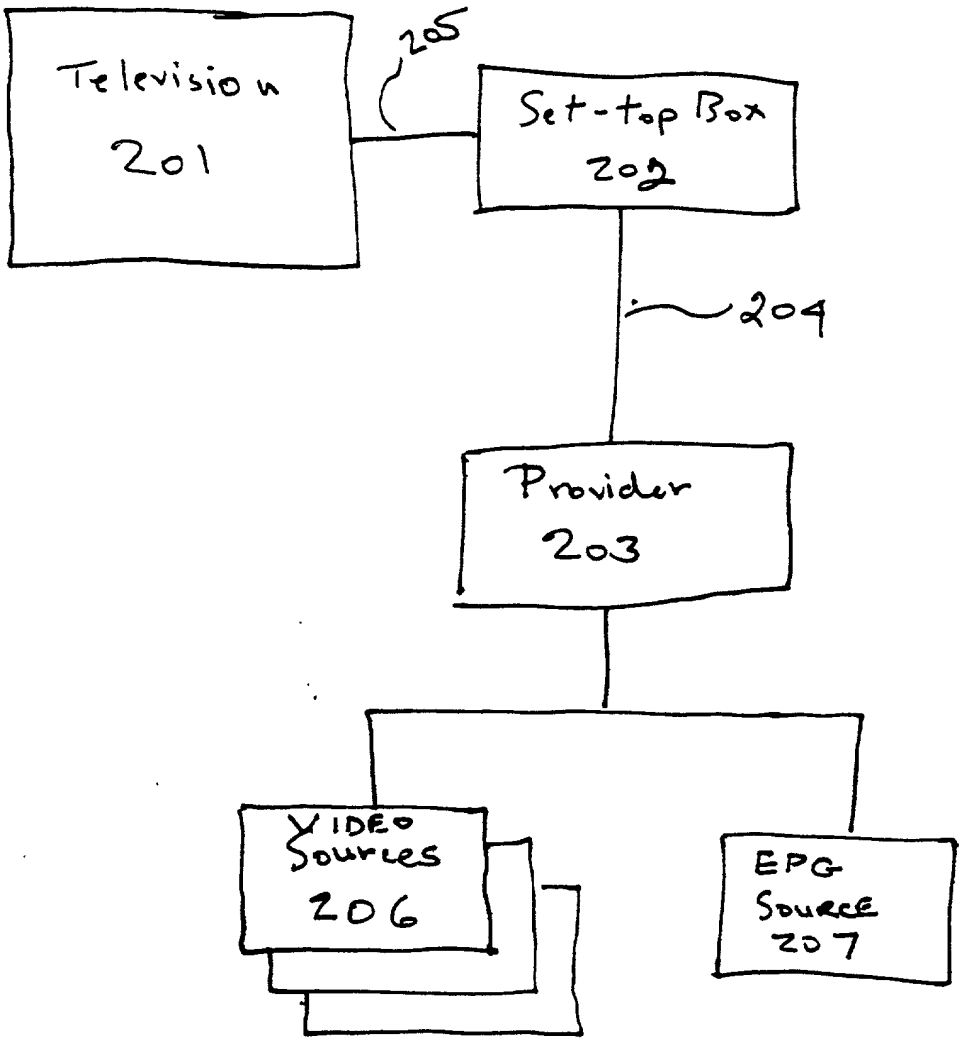

Television
201
205
Set-top Box
202
204
Provider
203
VIDEO
Sources
206
EPG
Source
207

FIG. 3A

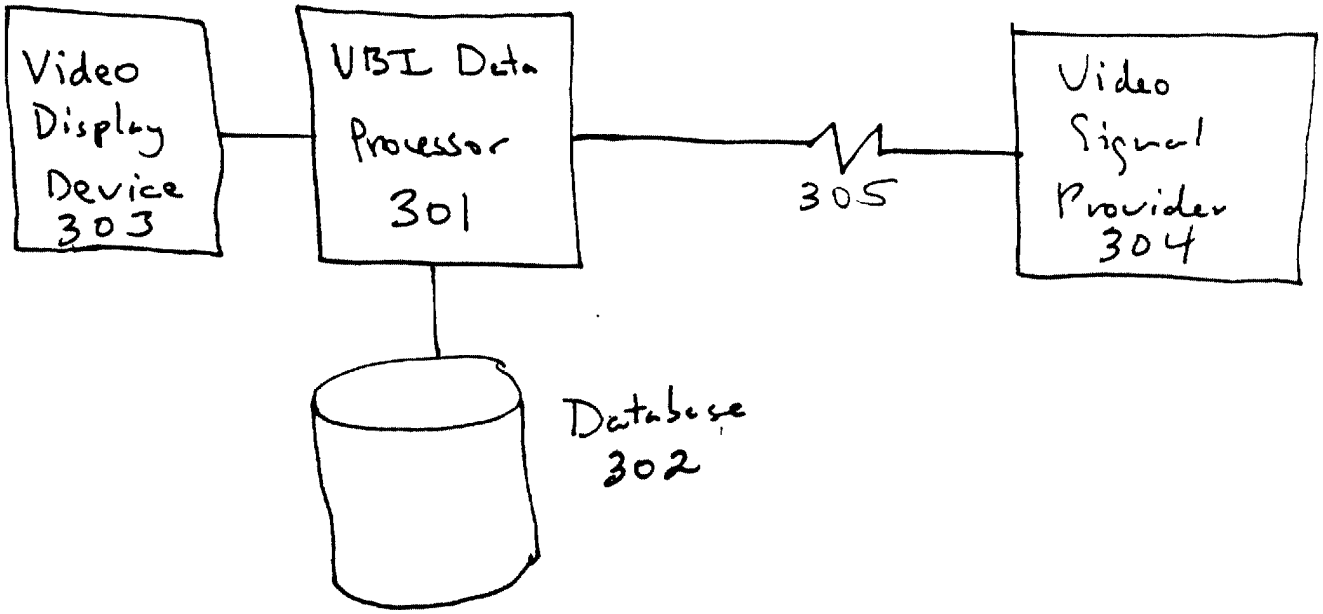


FIG. 3B

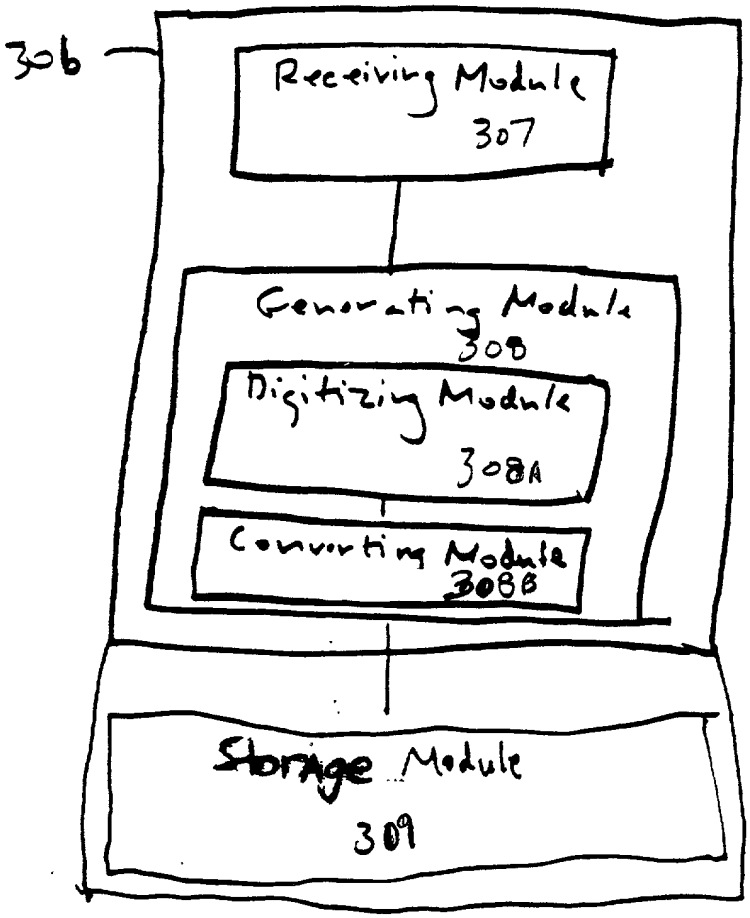

306
Receiving Module
307
Generating Module
308
Digitizing Module
308A
Converting Module
308B
Storage Module
309

FIG. 4

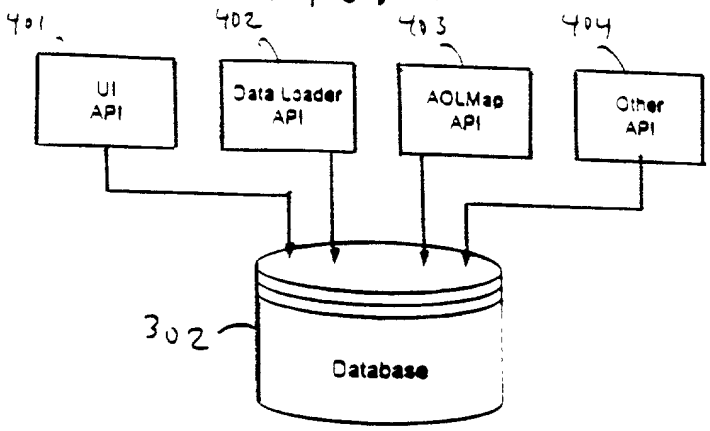

401
402
403
404
UI API
Data Loader API
AOLMap API
Other API
302
Database

FIG. 5

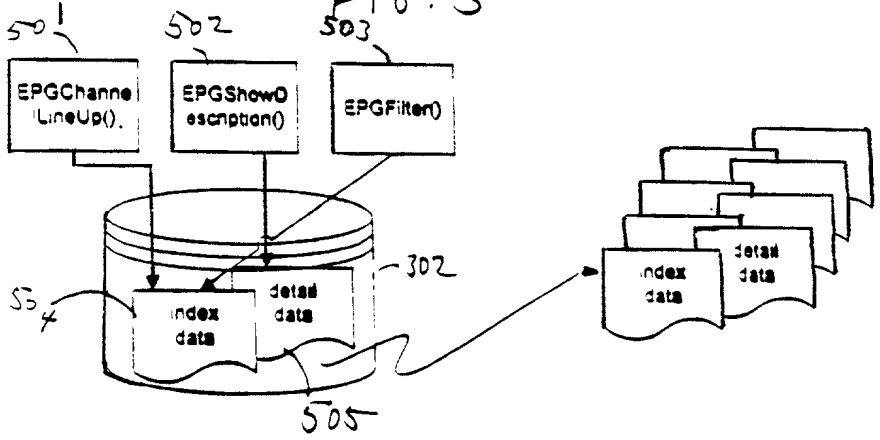

501
502
503
EPGChanne
lLineUp().
EPGShowD
escription()
EPGFilter()
302
index
data
detail
data
505
401

FIG. 6A

2. API for UI

2.1. EPGChannelLineup

Description Call this function to get a list of brief show information for a given range of AOL channel numbers and time frame. The returned show array is sorted in the order of AOL channel number and show beginning time.

Prototype Boolean EPGChannelLineup(const line_up & sline, show_info * const sinfo, int * const sorder, int &length,query_error & err);

Parameters

- sline: IN PARAMETER. This structure specifies time grids and the range of AOL channel numbers. The data structure is defined as:

```
struct line_up
{
    time_t time_grid_start;
    time_t time_grid_end;
    int aol_channel_id_start;
    int aol_channel_id_end;
}
```

- sinfo: OUT PARAMETER. sinfo is an array of type show_info.

```
struct show_info
{
    int   aol_channel_number;
    char  call_letter[9];
    time_t begin_time;
    short duration;
    unsigned char cat_index;
    unsigned char sub_cat_index;
    char     short_title[22];
    long   reference_number;
}
```

- sorder: OUT PARAMETER. It stores the order of shows sorted in AOL channel number and time. For example, sinfo[sorder[0]] is the first show, sinfo[sorder[1]] the second, etc.
- length: IN OUT PARAMETER. As an in parameter, length is the dimension of sinfo and sorder, as an out parameter, it is the actual number of shows stored in sinfo and sorder, provided the number is less than the input length. Otherwise, FALSE is returned and err is populated with messages.
- Err: OUT PARAMETER. This parameter holds error information if error occurs. Non-zero err_code means something wrong in the call. Query_error is defined as

```
struct query_error
{
    int  err_code;
    char err_msg[100];
}
```

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

2.2. EPGShowDescription

Description This function returns a detailed show data. In order to get detailed show info, caller needs to pass the beginning time (or date) and reference number of the show. Reference number of a show is obtained by calling EPGChannelLineup function.

Prototype Boolean EPGShowDescription(show_brief_info &sbrief, show_description & sdesc,query_error & err);

Parameters

- sbrief: IN PARAMETER. The struct show_brief_info is defined as

```
{
    time_t date;
    long  reference_number;
```

FIG. 6B

```
}
```

- sdesc: OUT PARAMETER. Detailed description of a show, including category, description, etc. The data structure is defined as

```
struct show_description
{
    char rest_of_title[100];
    char short_description[64];
    char description[801];
    char category[13];
    char subcategory[13];
    short year_produced;
    float stars;
    bool re_run;
    bool live;
    bool closed_caption;
    bool stereo;
    char tv_rating[13];
    char mpaa_rating[5];
}
```

- err: OUT PARAMETER.

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

2.3. EPGFilter

Description To get a list of shows having specified category-index and subcategory-index. Category-index and subcategory-index are numbers between 0 to 15.

Prototype Boolean EPGFilter(show_cat_info &scat, show_info * const sinfo, int * const sorder, int &length, query_error & err);

Parameters

- scat: IN PARAMETER. The data struct show_cat_info is defined as

```
struct show_cat_info
{
    short cat_index;
    short sub_cat_index;
    time_t begin_time;
    unsigned char updown_flag;
}
```

Above data structure specifies category index, subcategory index, beginning time of a search, and forward or backward search flag. Updown_flag=1 means forward search, 0 means backward search. The search is limited among the shows of the same day as the specified beginning time.

- sinfo: OUT PARAMETER. sinfo is an array of type show_info.
- sorder: OUT PARAMETER. It stores the order of shows sorted in AOL channel number and time. For example, sinfo[sorder[0]] is the first show, sinfo[sorder[1]] the second, etc.
- length: IN OUT PARAMETER. As an in parameter, length is the dimension of sinfo and sorder, as an out parameter, it is the actual number of shows stored in sinfo and sorder, provided the number is less than the input length. Otherwise, FALSE is returned and err is populated.
- Err: OUT PARAMETER. This parameter holds error information if error occurs. Non-zero err_code means something is wrong in the call.

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

FIG. 7

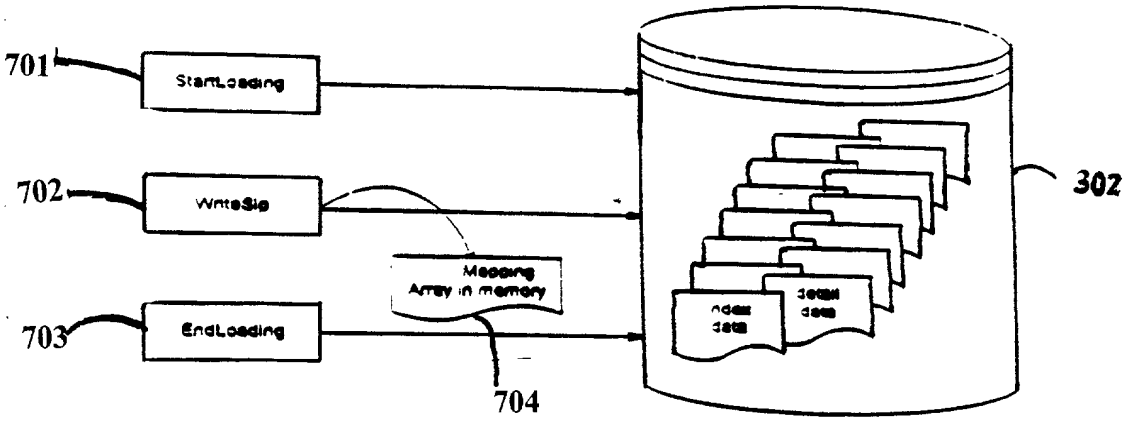

701
StartLoading
702
WriteSig
703
EndLoading
Mapping
Array in memory
704
302
402

FIG. 8A

1. API for Data Loader

1.1. TsipCallback::StartLoading

Description StartLoading is responsible for preparing database tables for the data loading. Therefore, this function must be called before data loading. After data loading is done, EndLoading function shall be called.

Prototype Boolean StartLoading()

Parameters None

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

1.2. TsipCallback:: StartSip

Description StartSip marks the beginning of the data loading of a show information packet. A show information packet contains 4-hour show data for one channel. EndSip indicates the end of the data loading of one packet.

Prototype Boolean StartSip()

Parameters None

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

1.3. TsipCallback:: WriteSip

Description WriteSip inserts one or couple of show data into database tables.

Prototype Boolean WriteSip(const SipHeader &shdr, const Showinfo *psi, int length)

Parameters

- shdr: INPARAMETER. SipHeader contains common data shared by show data stored in the array Showinfo.

```
struct
TUNECHAN {
    unsigned char  type;      // b0-2: 0:OTA 1:cable 2:satellite 3-7: reserved
                              // b3: digital b4: dual A/B cable trunk b5-7: rsvd
    unsigned short minor;     // up to 10 bits of digital minor channel
    unsigned short major;     // up to 10 bits of digital major channel, or analog
                              // channel

}
struct SipHeader
{
   short      channel_id;      // unique Gemstar channel ID
   TUNECHAN tuned_channel;// see struct definition below
   char    channel_name[9]; // (null terminated string)
   unsigned char    day_of_week; // 0,1,2,6 for Sun,..., Saturday , respectively
   char    date[9];             // YYYYMMDD null terminated
   unsigned char    start_time;// Hour of block start (0-23).  Normally
                               // on 4 hour intervals (0, 4, 8, 12,16, 20)

}
```

- psi: IN PARAMETER. Showinfo is defined as

```
struct Showinfo
{
    char    short_title[22];     // short title, as displayed on grid titles
    char    rest_of_title[100];  // concatenated with short title,
                                 //the complete show title
    char   short_description[64];// short description. Enough
            // descriptive text to fit 3x21 display. (includes ratings for movies,
            // teams for sports, subjects for talk shows, etc.char
            // null terminated
    char   long_description[801];
            // with short description, complete description  null terminated
    char   begin_time[15];
```

FIG. 8B

```
                    // Show starting time with format of YYYYMMDDHHMI
                    // null terminated, MM takes a value of 01,....,12;
                    // DD takes a value of 01,... ,31; HH takes
                    //  a value of 00,... ,23; MI takes a value from 00 to 59.
        char    end_time[15];   // as above, used for performance purpose
        int             duration;// in minutes
        char    category[13];   // category name, null terminated
        unsigned char   cat_index;
        char    subcategory[13];        // sub-category name, null terminated
        unsigned char   sub_cat_index;
        short   year_produced;          // four digits, e.g. 1998. For search purpose
        float   stars;                  // 0,0.5,1,1.5,2,....,4,5,5 for search purpose
        bool    re_run;
        bool    live;
        bool    closed_caption;
        bool    stereo;
        char    TV_rating[13];  // "TVMA-FVDLVS", "TVY-LV",.. null terminated
        char    mpaa_rating[5]; // "NC17", "X",..., null terminated
    };
```

psi is the pointer of the array ShowInfo psi[length].

- length: IN PARAMETER. length tells how many show records in the array psi.

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

1.4. TsipCallback:: EndSip

Description EndSip marks the end of the data loading of a show information packet.
Prototype Void EndSip()
Parameters None
Return Value Void

1.5. TsipCallback:: EndLoading

Description After data loading is successfully completed, Data Loader calls EndLoading to invoke a sequence of actions on the database tables, such as clean up temporary tables and etc. If, for some reason, this API is not called, then show data for UI will not be updated.
Prototype Void EndLoading()
Parameters None
Return Value Void

FIG. 9

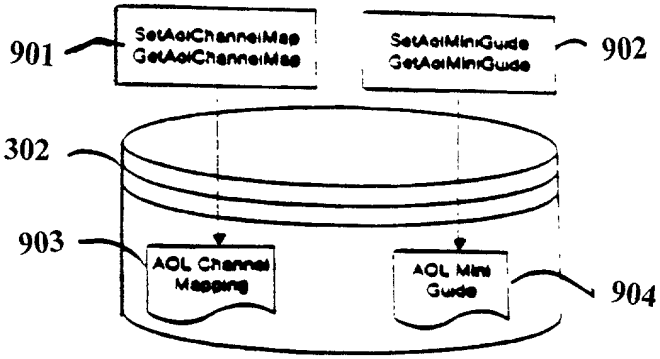

901
SetAolChannelMap
GetAolChannelMap
SetAolMiniGuide
GetAolMiniGuide
902
302
903
AOL Channel Mapping
AOL Mini Guide
904

FIG. 10A

3. API for AOL Channel Mapping

3.1. AOLMapGet

Description This function returns an array of AOL Channel Mapping data to the caller. AOL Channel Mapping describes the mapping among AOL Channel, Call letter, AOL Category, and Channel Id.

Prototype Boolean AOLMapGet(aol_channel_map * const minfo, int * const sorder,int &length,query_error & err)

Parameters

- minfo: OUT PARAMETER. The pointer minfo points to an array of aol_channel_map. The struct aol_channel_map is defined as

```
struct aol_channel_map
{
    char call_letter[9];
    unsigned short channel_id;
    unsigned short aol_channel;
    unsigned short aol_cat;
};
```

- sorder: OUT PARAMETER. It stores the order of AOL Channel Mappings sorted in AOL channel number.
- length: IN OUT PARAMETER. As an in parameter, length is the dimension of minfo and sorder, as an out parameter, it is the actual number of AOL Channel Mappings stored in minfo and sorder, provided the number is less than the input length. Otherwise, FALSE is returned and err is populated with messages.
- err: OUT PARAMETER. It holds error information if error occurs. Non-zero err_code means something wrong in the call.

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

3.2. AOLMapSet

Description Caller can set AOL Channel Information by calling this function. Inside of AOLMapSet, it checks each element of the array minfo against the records in database. If the call letter exists in the database, then update the row by the new data from minfo; if call letter doesn't exist in the database, then insert a new row into the database.

Prototype Boolean AOLMapSet(aol_channel_map * const minfo,int &length,query_error & err)

Parameters

- minfo: IN PARAMETER. The parameter minfo is an array of aol_channel_map. The struct aol_channel_map is defined as

```
struct aol_channel_map
{
    char call_letter[9];
    unsigned short channel_id;
    unsigned short aol_channel;
    unsigned short aol_cat;
}
```

- length: IN PARAMETER. It is the actual number of AOL Channel Mappings stored in minfo.
- Err: OUT PARAMETER. Non-zero err_code means something wrong in the call.

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

3.3. AOLMiniGuideGet

Description To get AOL Mini Guide data. AOL Mini Guide shows the mapping between AOL Category and AOL Channel. At present, there are about 12 AOL categories. Each AOL Category owns a segment of AOL Channels.

Prototype Boolean AOLMiniGuideGet(aol_mini_guide * const minfo, int * const sorder,int &length,query_error & err)

FIG. 10B

Parameters

- minfo: OUT PARAMETER. minfo is an array of aol_mini_guide. The data struct aol_mini_guide is defined as:

```
struct
{
    char name[15];          //AOL Category
    unsigned short channel; //AOL Channel number
    unsigned short offline;  // AOL Channel number starts at
    unsigned short start;  // AOL Channel segment starts at
    unsigned short end;  //AOL Channel segment ends at
    unsigned short dup_start;  //Local Channel starts at
}
```

- sorder: OUT PARAMETER. The order of AOL Mini Guides by AOL channel number.
- length: IN OUT PARAMETER. As an in parameter, length tells the dimension of minfo and sorder, as an out parameter, it is the actual number of AOL Mini Guides stored in minfo and sorder, provided the number is less than the input length. Otherwise, FALSE is returned.
- err: OUT PARAMETER. Non-zero err_code means something wrong in the call.

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

3.4. AOLMiniGuideSet

Description Caller can set AOL Mini Guides by calling this function. Inside of AOLMiniGuideSet, each element of the array minfo is checked against the records in database. If a category exists in the database, then update the row by the new data from minfo; if a category doesn't exist in the database, then insert a new row into the database.

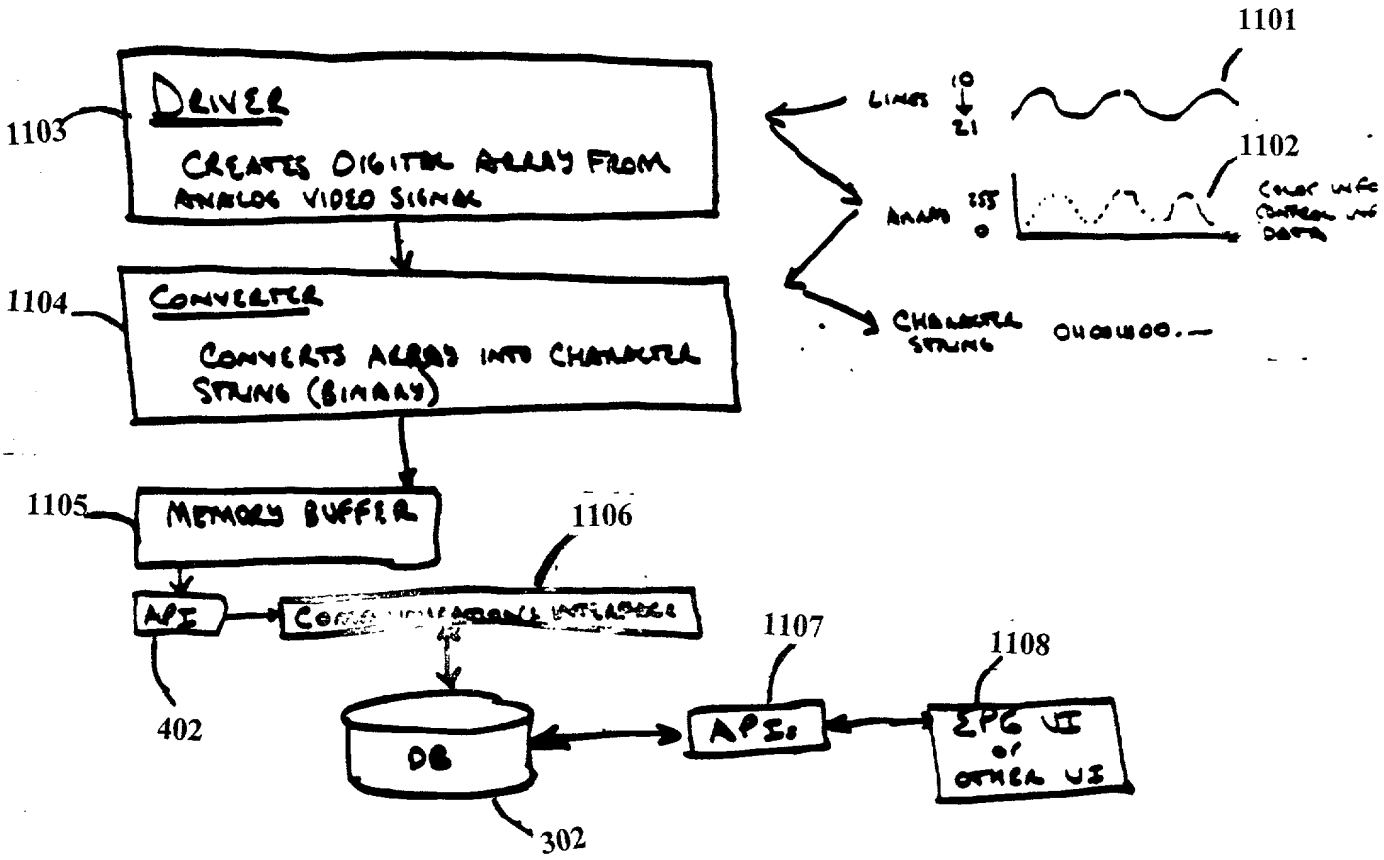
Prototype Boolean AOLMiniGuideSet(aol_mini_guide * const minfo,int &length,query_error & err)

Parameters

- minfo: IN PARAMETER. The pointer minfo points to an array of aol_mini_guide.
- length: IN PARAMETER. It is the actual number of AOL Mini Guides stored in minfo.
- Err: OUT PARAMETER. Non-zero err_code means something wrong in the call.

Return Value TRUE: Success
FALSE: Fails to prepare tables for data loading

FIG. 11 (Partial Software)



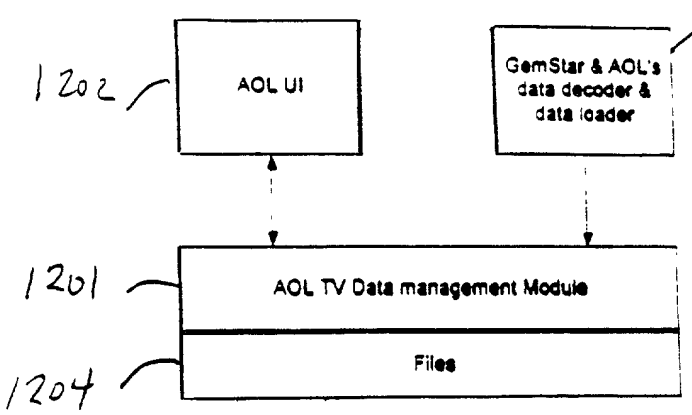
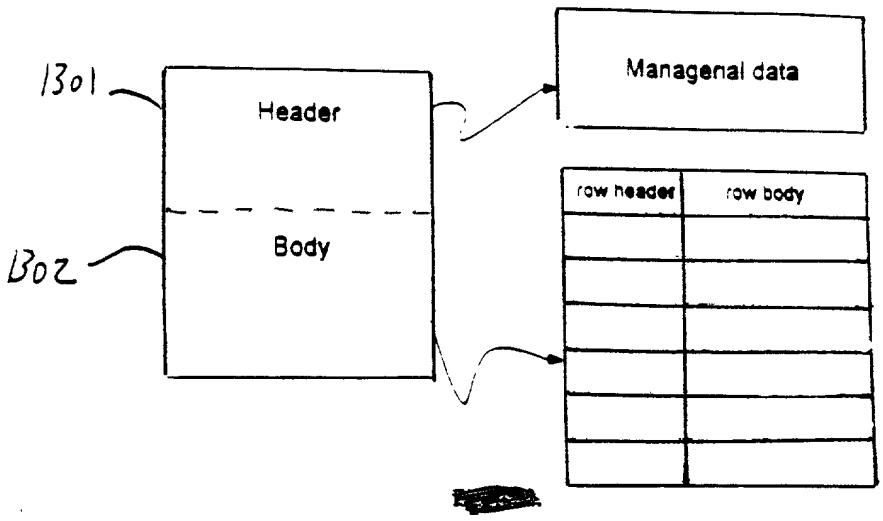


FIG. 12

FIG. 13



```
struct hdr_hdr
{
    char name[30];
    char f_name[30];
    char c_date[15];
    long t_row;
    long a_row;
    long na_row;
    short hdr_len;
    short row_start;
    short row_len;
    short row_hdr_len;
    short row_bdy_len;
    short row_hdr_start;
};
```

FIG. 14

where

- Name: Table name
- C_date: When the table is created, in the form "YYYYMMDDHHMISS"
- F_name: the file where the data is stored
- T_row: Total number of initialized rows
- Na_row: Next available row id for insertion
- Hdr_len: length of the header
- Row_start: where the data (row) start (=hdr_len);
- Row_len: the length of a row
- Row_hdr_len: length of the row header
- Row_bdy_len: the length of the row-body
- Row_hdr_start: Where the row-header starts

```
Struct row_hdr
{
    long row_id
    long next_available_row;
    char usage;
}
```

where

- Row_id: row id of the row. Increased by one each time
- Next_available_row: row id of the next available row for insertion
- usage: 'N' means available;'Y' means used

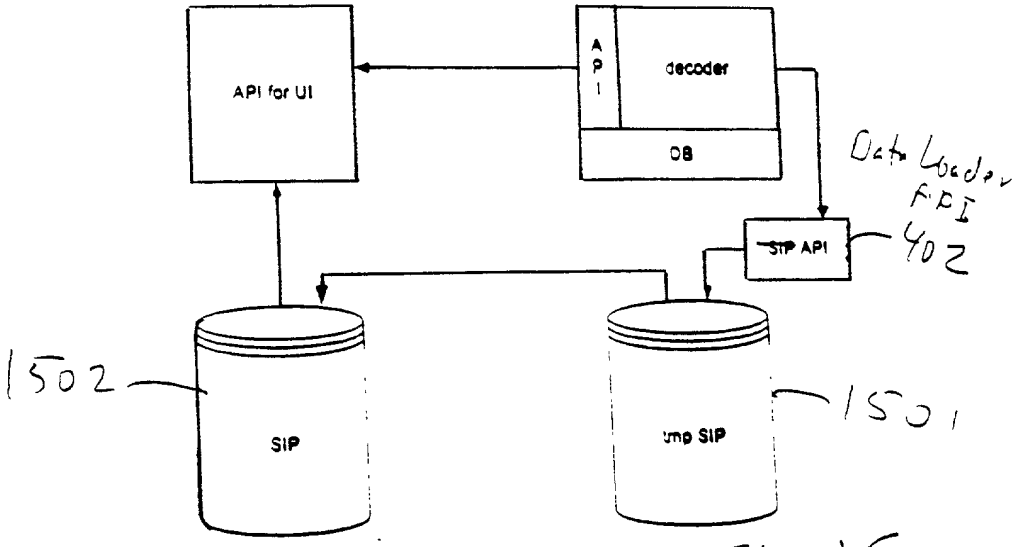

API for UI
A
P
I
decoder
DB
Data Loader
API
STP API
402
1502
SIP
tmp SIP
1501

FIG. 15

FIG 16